TFT LCD Tentative Specification

MODEL NO.: N173H6 - L04

Customer : _____

Approved by : _____

Note :

記錄	工作	審核	角色	投票
2009-04-02 19:21:03 CST	PMMD III Director	annie_hsu(徐凡琇 /56522 / 54873)	Director	Accept

Version 0.0

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REVISION HISTORY

Version	Date	Page (New)	Section	Description
Ver. 0.0	Mar. 31, '09	All	All	Tentative Specification was first issued.

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1. GENERAL DESCRIPTION

1.1 OVERVIEW

N173H6 - L04 is a 17.3" TFT Liquid Crystal Display module with LED Backlight unit and 40 pins LVDS interface. This module supports 1920 x 1080 FHD mode and can display 262,144 colors. The optimum viewing angle is at 6 o'clock direction. The inverter module for Backlight is built in.

1.2 FEATURES

- FHD (1920 x 1080 pixels) resolution

- DE only mode

- 3.3V LVDS (Low Voltage Differential Signaling) interface with 2 pixel/clock

- WLED

1.3 APPLICATION

- TFT LCD Notebook

1.4 GENERAL SPECIFICATI0NS

Item	Specification	Unit	Note
Active Area	381.888 (H) x 214.812 (V) (17.3" diagonal)	mm	(1)
Bezel Opening Area	386.88 (H) x 218.32 (V)	mm	
Driver Element	a-si TFT active matrix	-	-
Pixel Number	1920 x R.G.B. x 1080	pixel	-
Pixel Pitch	0.199 x 0.199	mm	-
Pixel Arrangement	RGB vertical stripe	-	-
Display Colors	262,144	color	-
Transmissive Mode	Normally white	-	-
Surface Treatment	Hard coating (3H), Glare	-	-

1.5 MECHANICAL SPECIFICATIONS

Item		Min.	Typ.	Max.	Unit	Note
Module Size	Horizontal (H)	397.6	398.1	398.6	mm	(1)
	Vertical (V)	232.3	232.8	233.3	mm	
	Depth (D)		5.5	5.8	mm	
Weight			555	570	g	

Note (1) Please refer to the attached drawings for more information of front and back outline dimensions.

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2. ABSOLUTE MAXIMUM RATINGS
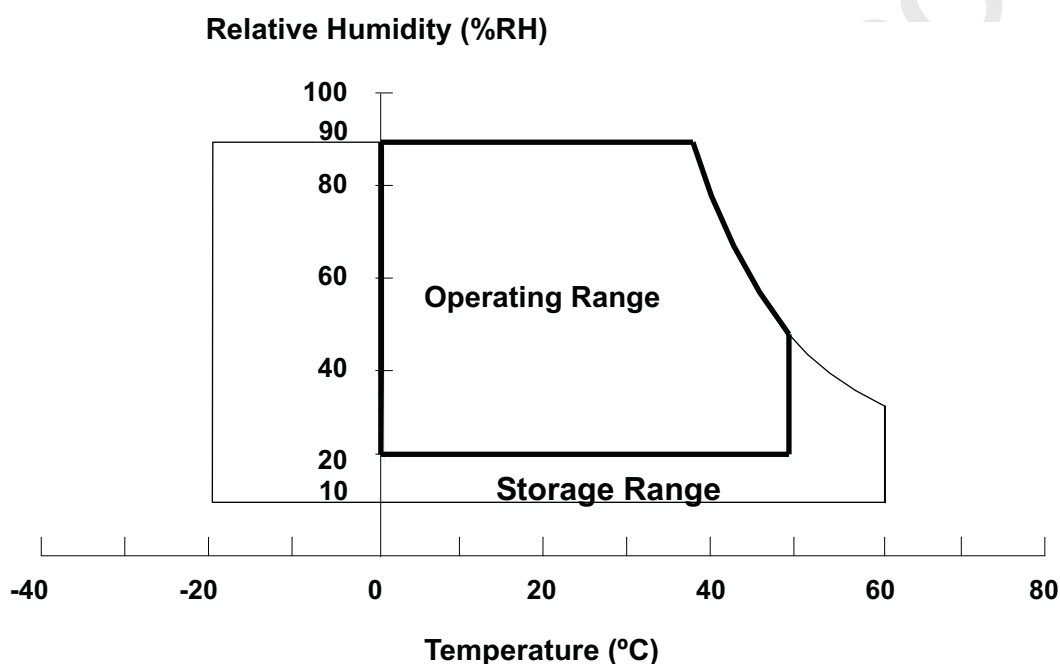
2.1 ABSOLUTE RATINGS OF ENVIRONMENT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Storage Temperature	T_{ST}	-20	+60	ºC	(1)
Operating Ambient Temperature	T_{OP}	0	+50	ºC	(1), (2)
Shock (Non-Operating)	S_{NOP}	-	220/2	G/ms	(3), (5)
Vibration (Non-Operating)	V_{NOP}	-	1.5	G	(4), (5)

Note (1) (a) 90 %RH Max. (Ta $\leqq$ 40 ºC).

(b) Wet-bulb temperature should be 39 ºC Max. (Ta > 40 ºC).

(c) No condensation.

Note (2) The temperature of panel display surface area should be 0 ºC Min. and 60 ºC Max.

Relative Humidity (%RH)

```
100 ─
 90 ─┌──────────────────┐
 80 ─│                  │\
     │                  │ \
 60 ─│   Operating Range│  \
     │                  │   \
 40 ─│                  │    \___
     │                  │        \
 20 ─│                  │         \
 10 ─└──────────────────┘          \
         Storage Range

   -40    -20    0    20    40    60    80
```

Temperature (ºC)

Note (3) 1 time for ± X, ± Y, ± Z. for Condition (220G / 2ms) is half Sine Wave,.

Note (4) 10 ~ 500 Hz, 30 min/cycle,1cycles for each X, Y, Z axis.

Note (5) At testing Vibration and Shock, the fixture in holding the module has to be hard and rigid

enough so that the module would not be twisted or bent by the fixture.

The fixing condition is shown as below:

At Room Temperature   LCD Module

Side Mount Fixing Screw ─────   ───── Side Mount Fixing Screw

                                                       Stage

Gap=2mm   Bracket

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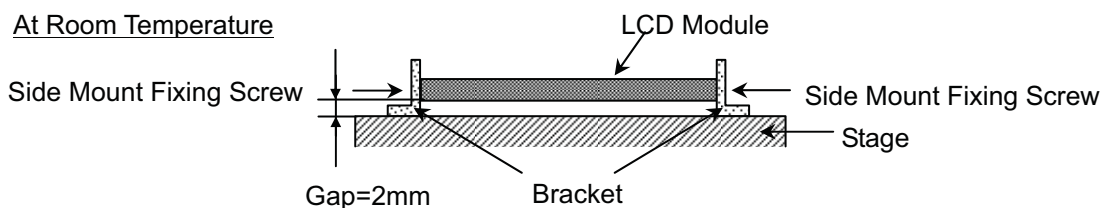
2.2 ELECTRICAL ABSOLUTE RATINGS

2.2.1 TFT LCD MODULE

Item	Symbol	Value		Unit	Note
		Min.	Max.		
Power Supply Voltage	V_{CC}	-0.3	+4.0	V	(1)
Logic Input Voltage	V_{IN}	-0.3	V_{CC}+0.3	V	

2.2.2 BACKLIGHT UNIT

Item	Symbol	Value		Unit	Note
		Min.	Max.		
LED Light Bar Power Supply Voltage	V_L	-45	31.5	V	(1), (2)
LED Light Bar Power Supply Current	I_L	0	200	mA	

Note (1) Permanent damage to the device may occur if maximum values are exceeded. Function operation should be restricted to the conditions described under Normal Operating Conditions.

Note (2) Specified values are for LED (Refer to 3.2 for further information).

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3. ELECTRICAL CHARACTERISTICS

3.1 TFT LCD MODULE

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Power Supply Voltage		Vcc	3.0	3.3	3.6	V	-
Permissive Ripple Voltage		V_{RP}		50		mV	-
Rush Current		I_{RUSH}			1.5	A	(2)
Initial Stage Current		I_{IS}			1.0	A	(2)
Power Supply Current	White			(320)		mA	(3)a
	Black			(750)		mA	(3)b
LVDS Differential Input High Threshold		$V_{TH(LVDS)}$			+100	mV	(5), V_{CM}=1.2V
LVDS Differential Input Low Threshold		$V_{TL(LVDS)}$	-100			mV	(5) V_{CM}=1.2V
LVDS Common Mode Voltage		V_{CM}	1.125		1.375	V	(5)
LVDS Differential Input Voltage		$|V_{ID}|$	100		600	mV	(5)
Terminating Resistor		R_T		100		Ohm	
Power per EBL WG		P_{EBL}	-	(TBD)	-	W	(4)

Note (1) The ambient temperature is Ta = 25 ± 2 ºC.

Note (2) I_{RUSH}: the maximum current when VCC is rising

I_{IS}: the maximum current of the first 100ms after power-on

Measurement Conditions: Shown as the following figure. Test pattern: black.

Vcc rising time is 470us

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Note (3) The specified power supply current is under the conditions at Vcc = 3.3 V, Ta = 25 ± 2 ºC, f_v = 60 Hz, whereas a power dissipation check pattern below is displayed.

a. White Pattern
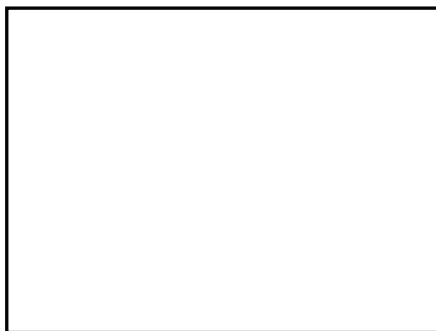
b. Black Pattern

Active Area
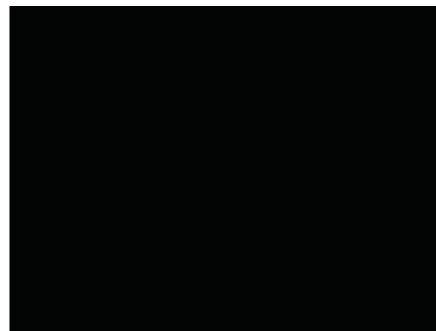
Active Area

Note (4) The specified power are the sum of LCD panel electronics input power and the inverter input power. Test conditions are as follows.
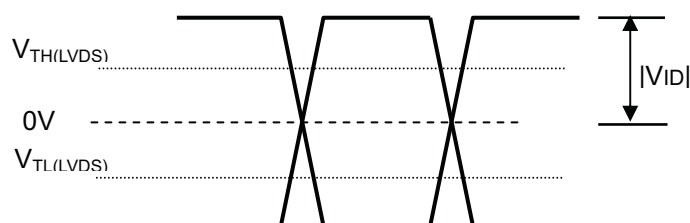
(a) Vcc = 3.3 V, Ta = 25 ± 2 ºC, f_v = 60 Hz,

(b) The pattern used is a black and white 32 x 36 checkerboard, slide #100 from the VESA file "Flat Panel Display Monitor Setup Patterns", FPDMSU.ppt.

(c) Luminance: 60 nits.

Note (5) The parameters of LVDS signals are defined as the following figures.

Single Ended

V_{CM}

$|V_{ID}|$

0V

Differential

$V_{TH(LVDS)}$

$|V_{ID}|$

0V

$V_{TL(LVDS)}$

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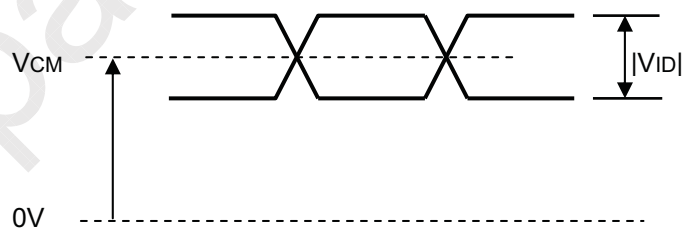
3.2 BACKLIGHT UNIT

Ta = 25 ± 2 ℃

Parameter	Symbol	Value			Unit	Note
		Min.	Typ.	Max.		
LED Light Bar Power Supply Voltage	V_L	25.2	28.8	31.5	V	(1),(2) (Duty 100%)
LED Light Bar Power Supply Current	I_L	152	160	168	mA	
Power Consumption	P_L	3.83	4.60	5.29	W	(3), (Duty 100%)
LED Life Time	L_{BL}	15000	-	-	Hrs	(4)

Note (1)   LED light bar configuration is shown as below.
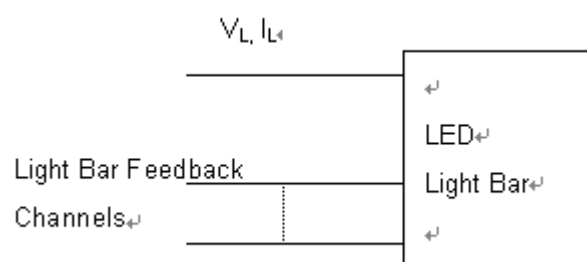
Note (2) For better LED light bar driving quality, it is recommended to utilize the adaptive boost converter with current balancing function to drive LED light-bar.
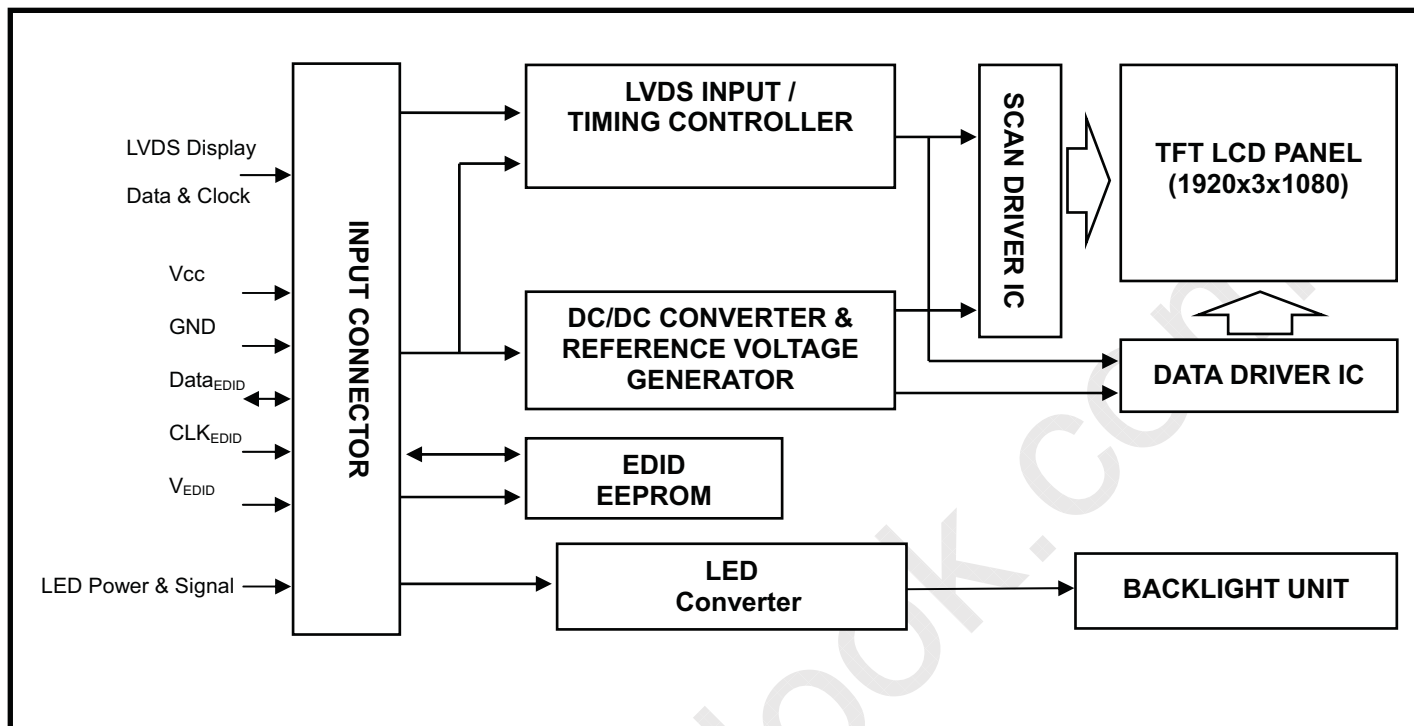
Note (3) $P_L = I_L \times V_L$

Note (4) The lifetime of LED is defined as the time when it continues to operate under the conditions at Ta = 25 ±2 ℃ and I_L = 20 mA(Per EA) until the brightness becomes $\leqq$ 50% of its original value.

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4. BLOCK DIAGRAM
4.1 TFT LCD MODULE

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5. INPUT TERMINAL PIN ASSIGNMENT

5.1 TFT LCD MODULE

Pin	Symbol	Description	Polarity	Remark
1	Vss	Non connection		
2	Vcc	Power Supply +3.3 V (typical)		
3	Vcc	Power Supply +3.3 V (typical)		
4	V_{EDID}	DDC 3.3V Power		
5	Reserve	Non connection		
6	CLK_{EDID}	DDC Clock		
7	$DATA_{EDID}$	DDC Data		
8	RXO0-	LVDS Differential Data Input (Odd)	Negative	
9	RXO0+	LVDS Differential Data Input (Odd)	Positive	
10	Vss	Ground		
11	RXO1-	LVDS Differential Data Input (Odd)	Negative	
12	RXO1+	LVDS Differential Data Input (Odd)	Positive	
13	Vss	Ground		
14	RXO2-	LVDS Differential Data Input (Odd)	Negative	
15	RXO2+	LVDS Differential Data Input (Odd)	Positive	
16	Vss	Ground		
17	RXOC-	LVDS Clock Data Input (Odd)	Negative	
18	RXOC+	LVDS Clock Data Input (Odd)	Positive	
19	Vss	Ground		
20	RxE0-	LVDS Differential Data Input (Even)	Negative	
21	RxE0+	LVDS Differential Data Input (Even)	Positive	
22	Vss	Ground		
23	RxE1-	LVDS Differential Data Input (Even)	Negative	
24	RxE1+	LVDS Differential Data Input (Even)	Positive	
25	Vss	Ground		
26	RxE2-	LVDS Differential Data Input (Even)	Negative	
27	RxE2+	LVDS Differential Data Input (Even)	Positive	
28	Vss	Ground		
29	RXEC-	LVDS Clock Data Input (Even)	Negative	
30	RXEC+	LVDS Clock Data Input (Even)	Positive	
31	GND	Ground		
32	LED_GND	LED Ground		
33	LED_GND	LED Ground		
34	Reserve	No Connection		
35	LED_PWM	System PWM Signal Input		
36	LED_EN	LED enable pin		
37	NC	No Connection		
38	LED_VCCS	LED Power		
39	LED_VCCS	LED Power		
40	LED_VCCS	LED Power		

Note (1) Connector Part No.: I-PEX 20455-040E-12, or equivalent

Note (2) User's connector Part No: I-PEX 20453-040T-01 or equivalent

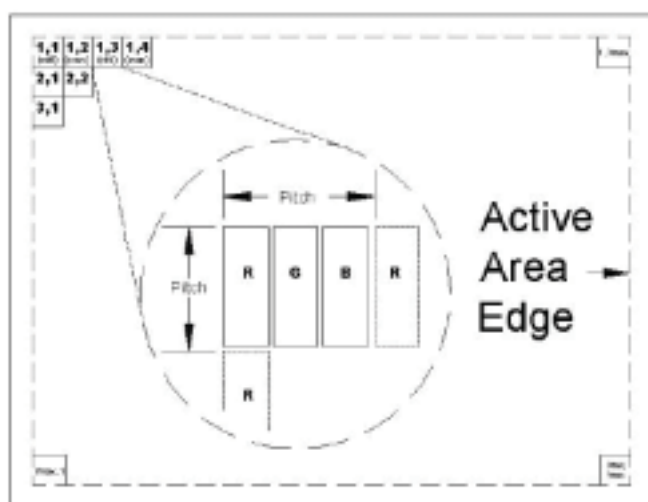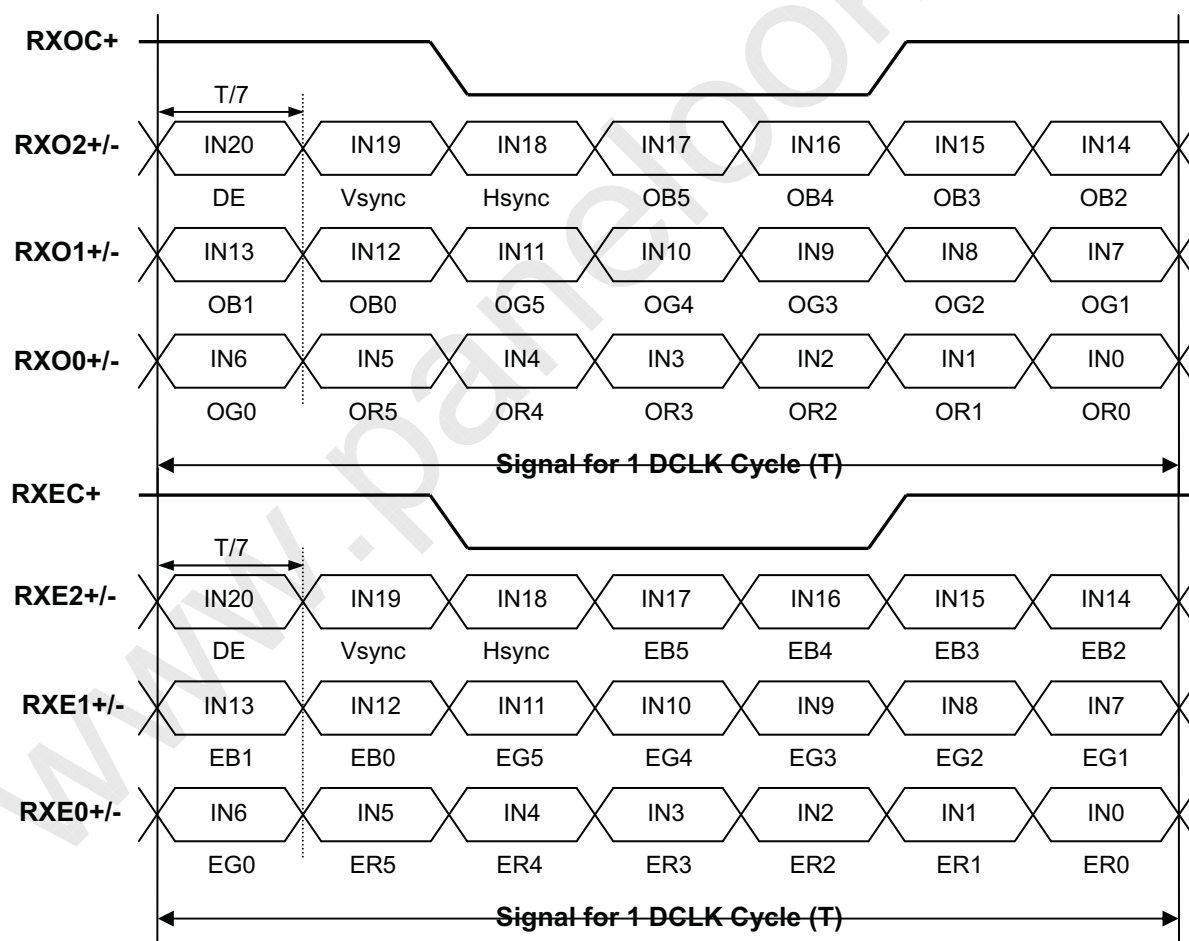Note (3) The first pixel is odd as shown in the following figure.

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5.2 TIMING DIAGRAM OF LVDS INPUT SIGNAL

RXOC+

RXO2+/-   T/7
| IN20 | IN19 | IN18 | IN17 | IN16 | IN15 | IN14 |
| DE | Vsync | Hsync | OB5 | OB4 | OB3 | OB2 |

RXO1+/-
| IN13 | IN12 | IN11 | IN10 | IN9 | IN8 | IN7 |
| OB1 | OB0 | OG5 | OG4 | OG3 | OG2 | OG1 |

RXO0+/-
| IN6 | IN5 | IN4 | IN3 | IN2 | IN1 | IN0 |
| OG0 | OR5 | OR4 | OR3 | OR2 | OR1 | OR0 |

Signal for 1 DCLK Cycle (T)

RXEC+

RXE2+/-   T/7
| IN20 | IN19 | IN18 | IN17 | IN16 | IN15 | IN14 |
| DE | Vsync | Hsync | EB5 | EB4 | EB3 | EB2 |

RXE1+/-
| IN13 | IN12 | IN11 | IN10 | IN9 | IN8 | IN7 |
| EB1 | EB0 | EG5 | EG4 | EG3 | EG2 | EG1 |

RXE0+/-
| IN6 | IN5 | IN4 | IN3 | IN2 | IN1 | IN0 |
| EG0 | ER5 | ER4 | ER3 | ER2 | ER1 | ER0 |

Signal for 1 DCLK Cycle (T)

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5.3 COLOR DATA INPUT ASSIGNMENT

The brightness of each primary color (red, green and blue) is based on the 6-bit gray scale data input for the color. The higher the binary input, the brighter the color. The table below provides the assignment of color versus data input.

Color		Data Signal																	
		Red						Green						Blue					
		R5	R4	R3	R2	R1	R0	G5	G4	G3	G2	G1	G0	B5	B4	B3	B2	B1	B0
Basic Colors	Black	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
	Green	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
	Blue	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1
	Cyan	0	0	0	0	0	0	1	1	1	1	1	1	1	1	1	1	1	1
	Magenta	1	1	1	1	1	1	0	0	0	0	0	0	1	1	1	1	1	1
	Yellow	1	1	1	1	1	1	1	1	1	1	1	1	0	0	0	0	0	0
	White	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1	1
Gray Scale Of Red	Red(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(1)	0	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(2)	0	0	0	0	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Red(61)	1	1	1	1	0	1	0	0	0	0	0	0	0	0	0	0	0	0
	Red(62)	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0	0
	Red(63)	1	1	1	1	1	1	0	0	0	0	0	0	0	0	0	0	0	0
Gray Scale Of Green	Green(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Green(1)	0	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0
	Green(2)	0	0	0	0	0	0	0	0	0	0	1	0	0	0	0	0	0	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Green(61)	0	0	0	0	0	0	1	1	1	1	0	1	0	0	0	0	0	0
	Green(62)	0	0	0	0	0	0	1	1	1	1	1	0	0	0	0	0	0	0
	Green(63)	0	0	0	0	0	0	1	1	1	1	1	1	0	0	0	0	0	0
Gray Scale Of Blue	Blue(0)/Dark	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0
	Blue(1)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1
	Blue(2)	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	0	1	0
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:	:
	Blue(61)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	0	1
	Blue(62)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	0
	Blue(63)	0	0	0	0	0	0	0	0	0	0	0	0	1	1	1	1	1	1

Note (1) 0: Low Level Voltage, 1: High Level Voltage

5.4 EDID DATA STRUCTURE

The EDID (Extended Display Identification Data) data formats are to support displays as defined in the

Byte #(decimal)	Byte #(hex)	Field Name and Comments	Value(hex)	Value(binary)
0	0	Header	00	00000000
1	1	Header	FF	11111111
2	2	Header	FF	11111111
3	3	Header	FF	11111111
4	4	Header	FF	11111111
5	5	Header	FF	11111111
6	6	Header	FF	11111111
7	7	Header	00	00000000
8	8	EISA ID manufacturer name ("CMO")	0D	00001101
9	9	EISA ID manufacturer name (Compressed ASCII)	AF	10101111
10	0A	ID product code (N173H6-L04)	15	00010101
11	0B	ID product code (hex LSB first; N173H6-L04)	17	00010111
12	0C	ID S/N (fixed "0")	00	00000000
13	0D	ID S/N (fixed "0")	00	00000000
14	0E	ID S/N (fixed "0")	00	00000000
15	0F	ID S/N (fixed "0")	00	00000000
16	10	Week of manufacture (fixed week code)	2C	00101100
17	11	Year of manufacture (fixed year code)	13	00010011
18	12	EDID structure version # ("1")	01	00000001
19	13	EDID revision # ("3")	03	00000011
20	14	Video I/P definition ("digital")	80	10000000
21	15	Max H image size ("38.208cm")	26	00100110
22	16	Max V image size ("21.832cm")	16	00010110
23	17	Display Gamma (Gamma = "2.2")	78	01111000
24	18	Feature support ("Active off, RGB Color")	0A	00001010
25	19	Rx1, Rx0, Ry1, Ry0, Gx1, Gx0, Gy1, Gy0	05	00000101
26	1A	Bx1, Bx0, By1, By0, Wx1, Wx0, Wy1, Wy0	35	00110101
27	1B	Rx=0.609	9C	10011100
28	1C	Ry=0.348	59	01011001
29	1D	Gx=0.333	55	01010101
30	1E	Gy=0.583	95	10010101
31	1F	Bx=0.16	29	00101001
32	20	By=0.081	14	00010100
33	21	Wx=0.313	50	01010000
34	22	Wy=0.329	54	01010100
35	23	Established timings 1	00	00000000
36	24	Established timings 2	00	00000000
37	25	Manufacturer's reserved timings	00	00000000
38	26	Standard timing ID # 1	01	00000001
39	27	Standard timing ID # 1	01	00000001
40	28	Standard timing ID # 2	01	00000001
41	29	Standard timing ID # 2	01	00000001

42	2A	Standard timing ID # 3	01	00000001
43	2B	Standard timing ID # 3	01	00000001
44	2C	Standard timing ID # 4	01	00000001
45	2D	Standard timing ID # 4	01	00000001
46	2E	Standard timing ID # 5	01	00000001
47	2F	Standard timing ID # 5	01	00000001
48	30	Standard timing ID # 6	01	00000001
49	31	Standard timing ID # 6	01	00000001
50	32	Standard timing ID # 7	01	00000001
51	33	Standard timing ID # 7	01	00000001
52	34	Standard timing ID # 8	01	00000001
53	35	Standard timing ID # 8	01	00000001
54	36	Detailed timing description # 1 Pixel clock ("138.65MHz", According to VESA CVT Rev1.1)	29	00101001
55	37	# 1 Pixel clock (hex LSB first)	36	00110110
56	38	# 1 H active ("1920")	80	10000000
57	39	# 1 H blank ("160")	A0	10100000
58	3A	# 1 H active : H blank ("1920 : 160")	70	01110000
59	3B	# 1 V active ("1080")	38	00111000
60	3C	# 1 V blank ("31")	1F	00011111
61	3D	# 1 V active : V blank ("1080 :31")	40	01000000
62	3E	# 1 H sync offset ("48")	30	00110000
63	3F	# 1 H sync pulse width ("32")	20	00100000
64	40	# 1 V sync offset : V sync pulse width ("3 : 5")	35	00110101
65	41	# 1 H sync offset : H sync pulse width : V sync offset : V sync width ("48: 32 : 3 : 5")	00	00000000
66	42	# 1 H image size ("382.08 mm")	7E	01111110
67	43	# 1 V image size ("218.32 mm")	DA	11011010
68	44	# 1 H image size : V image size ("382 : 218")	10	00010000
69	45	# 1 H boarder ("0")	00	00000000
70	46	# 1 V boarder ("0")	00	00000000
71	47	# 1 Non-interlaced, Normal, no stereo, Separate sync, H/V pol Negatives	18	00011000
72	48	Detailed timing description # 2	00	00000000
73	49	# 2 Flag	00	00000000
74	4A	# 2 Reserved	00	00000000
75	4B	# 2 FE (hex) defines ASCII string (Model Name "N173H6-L04", ASCII)	FE	11111110
76	4C	# 2 Flag	00	00000000
77	4D	# 2 1st character of name ("N")	4E	01001110
78	4E	# 2 2nd character of name ("1")	31	00110001
79	4F	# 2 3rd character of name ("7")	37	00110111
80	50	# 2 4th character of name ("3")	33	00110011
81	51	# 2 5th character of name ("H")	48	01001000
82	52	# 2 6th character of name ("6")	36	00110110
83	53	# 2 7th character of name ("-")	2D	00101101
84	54	# 2 8th character of name ("L")	4C	01001100
85	55	# 2 9th character of name ("0")	30	00110000

86	56	# 2 9th character of name ("4")	34	00110100
87	57	# 2 New line character indicates end of ASCII string	0A	00001010
88	58	# 2 Padding with "Blank" character	20	00100000
89	59	# 2 Padding with "Blank" character	20	00100000
90	5A	Detailed timing description # 3	00	00000000
91	5B	# 3 Flag	00	00000000
92	5C	# 3 Reserved	00	00000000
93	5D	# 3 FE (hex) defines ASCII string (Vendor "CMO", ASCII)	FE	11111110
94	5E	# 3 Flag	00	00000000
95	5F	# 3 1st character of string ("C")	43	01000011
96	60	# 3 2nd character of string ("M")	4D	01001101
97	61	# 3 3rd character of string ("O")	4F	01001111
98	62	# 3 New line character indicates end of ASCII string	0A	00001010
99	63	# 3 Padding with "Blank" character	20	00100000
100	64	# 3 Padding with "Blank" character	20	00100000
101	65	# 3 Padding with "Blank" character	20	00100000
102	66	# 3 Padding with "Blank" character	20	00100000
103	67	# 3 Padding with "Blank" character	20	00100000
104	68	# 3 Padding with "Blank" character	20	00100000
105	69	# 3 Padding with "Blank" character	20	00100000
106	6A	# 3 Padding with "Blank" character	20	00100000
107	6B	# 3 Padding with "Blank" character	20	00100000
108	6C	Detailed timing description # 4	00	00000000
109	6D	# 4 Flag	00	00000000
110	6E	# 4 Reserved	00	00000000
111	6F	# 4 FE (hex) defines ASCII string (Model Name"N173H6-L04", ASCII)	FE	11111110
112	70	# 4 Flag	00	00000000
113	71	# 4 1st character of name ("N")	4E	01001110
114	72	# 4 2nd character of name ("1")	31	00110001
115	73	# 4 3rd character of name ("7")	37	00110111
116	74	# 4 4th character of name ("3")	33	00110011
117	75	# 4 5th character of name ("H")	48	01001000
118	76	# 4 6th character of name ("6")	36	00110110
119	77	# 4 7th character of name ("-")	2D	00101101
120	78	# 4 8th character of name ("L")	4C	01001100
121	79	# 4 9th character of name ("0")	30	00110000
122	7A	# 4 9th character of name ("4")	34	00110100
123	7B	# 4 New line character indicates end of ASCII string	0A	00001010
124	7C	# 4 Padding with "Blank" character	20	00100000
125	7D	# 4 Padding with "Blank" character	20	00100000
126	7E	Extension flag	00	00000000
127	7F	Checksum	E9	11101001

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6. CONVERTER SPECIFICATION

6.1 ABSOLUTE MAXIMUM RATINGS

Symbol	Ratings
LED_VCCS	-0.3V~28.0V
LED_GND	-0.3V
LED_PWM, LED_EN	-0.3V~5V

6.2 RECOMMENDED OPERATING RATINGS

Parameter		Symbol	Value			Unit	Note
			Min.	Typ.	Max.		
Converter Input power supply voltage		LED_Vccs	(6.0)	(12.0)	(21.0)	V	
EN Control Level	Backlight On		(2.0)	---	(5.0)	V	
	Backlight Off		(0.0)	---	(0.8)	V	
PWM Control Level	PWM High Level		(2.0)	---	(5.0)	V	
	PWM Low Level		(0.0)	---	(0.15)	V	
PWM Control Duty Ratio			20		100	%	
PWM Control Permissive Ripple Voltage		V_{PWM_pp}			100	mV	
PWM Control Frequency		f_{PWM}	(190)	(210)	(230)	Hz	
Converter Input Current	LED_VCCS=Min	I_{BL}	(591)	(703)	(833)	mA	(1)
	LED_VCCS=Typ		(296)	(351)	(417)		(1)
	LED_VCCS=Max		(169)	(201)	(238)	mA	(1)

Note (1) The specified LED power supply current is under the conditions at "LED_VCCS = Min, Typ, Max",

Ta = 25 ± 2 ºC, f_{PWM} = 200 Hz, Duty=100%.

6.3 LED BACKLIGHT CONTROLL POWER SEQUENCE

Timing Specifications:
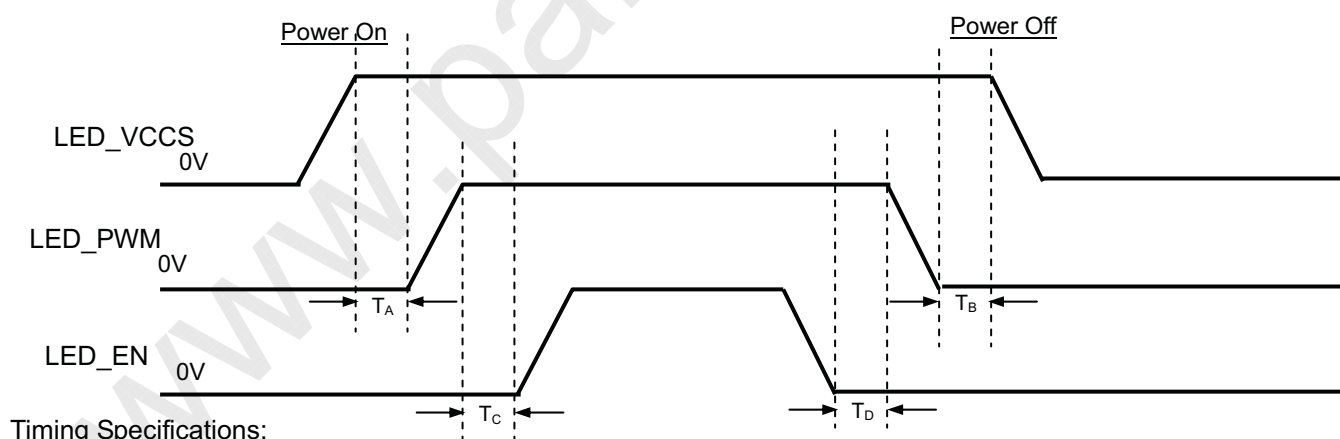
$T_A \geqq (0ms)$

$T_B \geqq (0ms)$

$T_C \geqq (10ms)$

$T_D \geqq (0ms)$

Note (1)   Please follow the LED backlight power sequence as above. If the customer could not follow, it might cause backlight flash issue during display ON/OFF or damage the LED backlight controller

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7. INTERFACE TIMING

7.1 INPUT SIGNAL TIMING SPECIFICATIONS

The input signal timing specifications are shown as the following table and timing diagram.

Signal	Item	Symbol	Min.	Typ.	Max.	Unit	Note
DCLK	Frequency	1/Tc	TBD	138.65	TBD	MHz	(2)
DE	Vertical Total Time	TV	(1082)	1111	(1350)	TH	-
	Vertical Active Display Period	TVD	1080	1080	1080	TH	-
	Vertical Active Blanking Period	TVB	TV-TVD	31	TV-TVD	TH	
	Horizontal Total Time	TH	(2000)	2080	(2400)	Tc	(2)
	Horizontal Active Display Period	THD	1920	1920	1920	Tc	(2)
	Horizontal Active Blanking Period	THB	TH-THD	160	TH-THD	Tc	(2)

Note (1) Because this module is operated by DE only mode, Hsync and Vsync are ignored.

   (2) 2 channels LVDS input.

INPUT SIGNAL TIMING DIAGRAM

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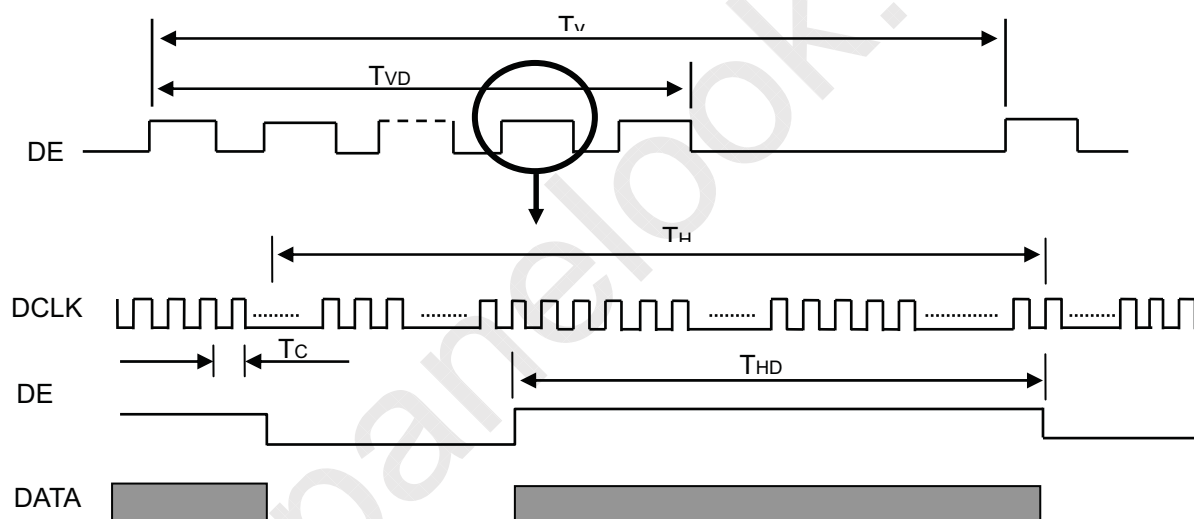
7.2 POWER ON/OFF SEQUENCE
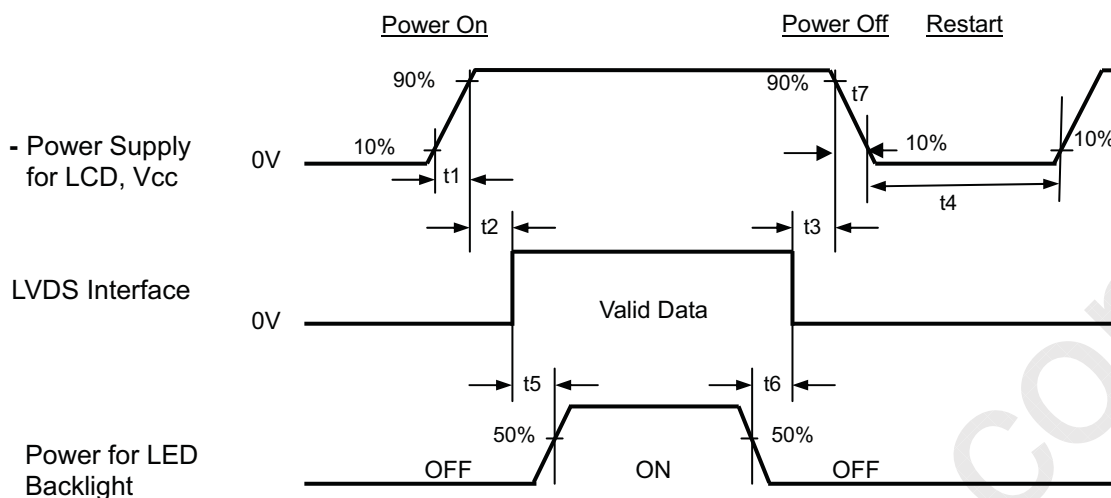
Timing Specifications:

$0.5 \leqq t1 \leqq 10$ ms

$0 \leqq t2 \leqq 50$ ms

$0 \leqq t3 \leqq 50$ ms

$t4 \geqq 500$ ms

$t5 \geqq 200$ ms

$t6 \geqq 200$ ms

Note (1) Please follow the power on/off sequence described above. Otherwise, the LCD module might be damaged.

Note (2) Please avoid floating state of interface signal at invalid period. When the interface signal is invalid, be sure to pull down the power supply of LCD Vcc to 0 V.

Note (3) The Backlight converter power must be turned on after the power supply for the logic and the interface signal is valid. The Backlight inverter power must be turned off before the power supply for the logic and the interface signal is invalid.

Note (4) Sometimes some slight noise shows when LCD is turned off (even backlight is already off). To avoid this phenomenon, we suggest that the Vcc falling time is better to follow $(50us) \leqq t7 \leqq (10$ ms).

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8. OPTICAL CHARACTERISTICS

8.1 TEST CONDITIONS

Item	Symbol	Value	Unit
Ambient Temperature	Ta	25±2	^{o}C
Ambient Humidity	Ha	50±10	%RH
Supply Voltage	V_{CC}	3.3	V
Input Signal	According to typical value in "3. ELECTRICAL CHARACTERISTICS"		
LED Lightbar power supply Current	I_L	160	mA

The relative measurement methods of optical characteristics are shown in 8.2. The following items should be

measured under the test conditions described in 8.1 and stable environment shown in Note (5).

8.2 OPTICAL SPECIFICATIONS

Item		Symbol	Condition	Min.	Typ.	Max.	Unit	Note
Color Chromaticity	Red	Rx	$\theta_x=0°$, $\theta_Y=0°$ CS-1000T	Typ – 0.03	(0.622)	Typ + 0.03		(1), (5)
		Ry			(0.354)			
	Green	Gx			(0.337)			
		Gy			(0.595)			
	Blue	Bx			(0.162)			
		By			(0.083)			
	White	Wx			0.313			
		Wy			0.329			
Average Luminance of White		L_{AVE}		180	220		cd/m^2	(4), (5)
Contrast Ratio		CR		500	650		-	(2), (5)
Response Time		T_R	$\theta_x=0°$, $\theta_Y=0°$	---	2	8	ms	(3)
		T_F		---	6	12	ms	
White Variation		δW	$\theta_x=0°$, $\theta_Y=0°$	---	1.25	1.40	-	(5), (6)
Viewing Angle	Horizontal	θ_x+	CR $\geqq$ 10	40	45	---	Deg.	(1), (5)
		θ_x-		40	45	---		
	Vertical	θ_Y+		20	25	---		
		θ_Y-		40	45	---		

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Note (1) Definition of Viewing Angle (θx, θy):

Normal

θx = θy = 0º

θy-   θy+

θx- = 90º   x-

12 o'clock direction

θy+ = 90º

y+

θx–   θx+

6 o'clock   y-

θy- = 90º

x+   θx+ = 90º
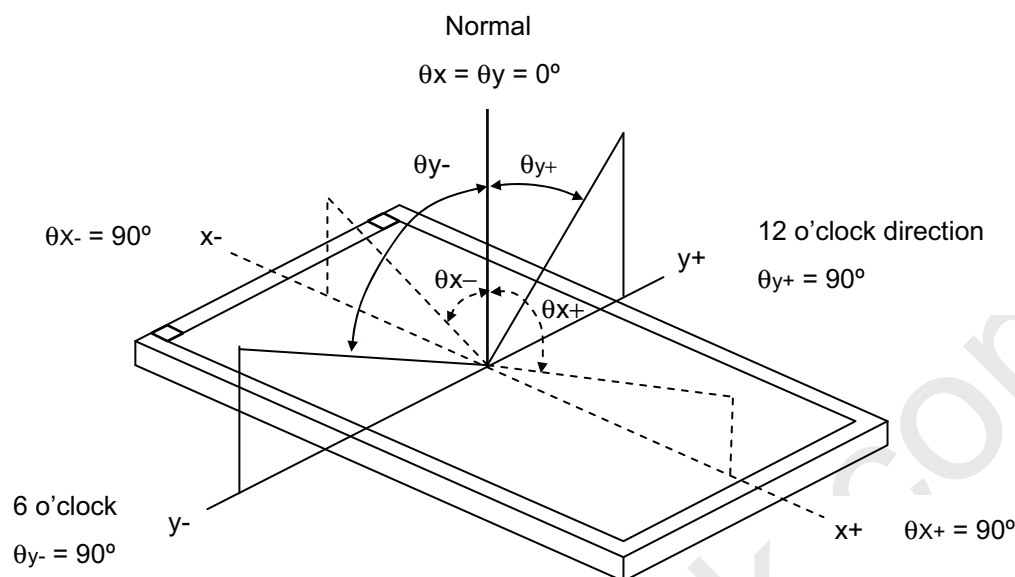
Note (2) Definition of Contrast Ratio (CR):

The contrast ratio can be calculated by the following expression.

Contrast Ratio (CR) = L63 / L0

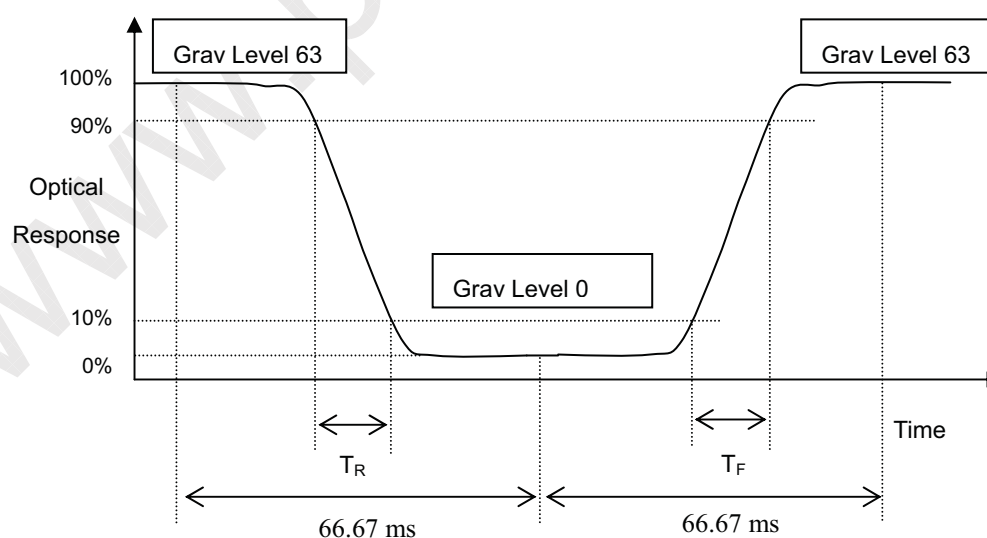L63: Luminance of gray level 63

L 0: Luminance of gray level 0

CR = CR (1)

CR (X) is corresponding to the Contrast Ratio of the point X at Figure in Note (6).

Note (3) Definition of Response Time (T_R, T_F):

Grav Level 63   Grav Level 63

100%

90%

Optical

Response

Grav Level 0

10%

0%

T_R T_F Time

66.67 ms   66.67 ms

Version 0.0

Note (4) Definition of Average Luminance of White (L_{AVE}):

Measure the luminance of gray level 63 at 5 points

L_{AVE} = [L (1)+ L (2)+ L (3)+ L (4)+ L (5)] / 5

L (x) is corresponding to the luminance of the point X at Figure in Note (6)

Note (5) Measurement Setup:

The LCD module should be stabilized at given temperature for 20 minutes to avoid abrupt temperature change during measuring. In order to stabilize the luminance, the measurement should be executed after lighting Backlight for 20 minutes in a windless room.

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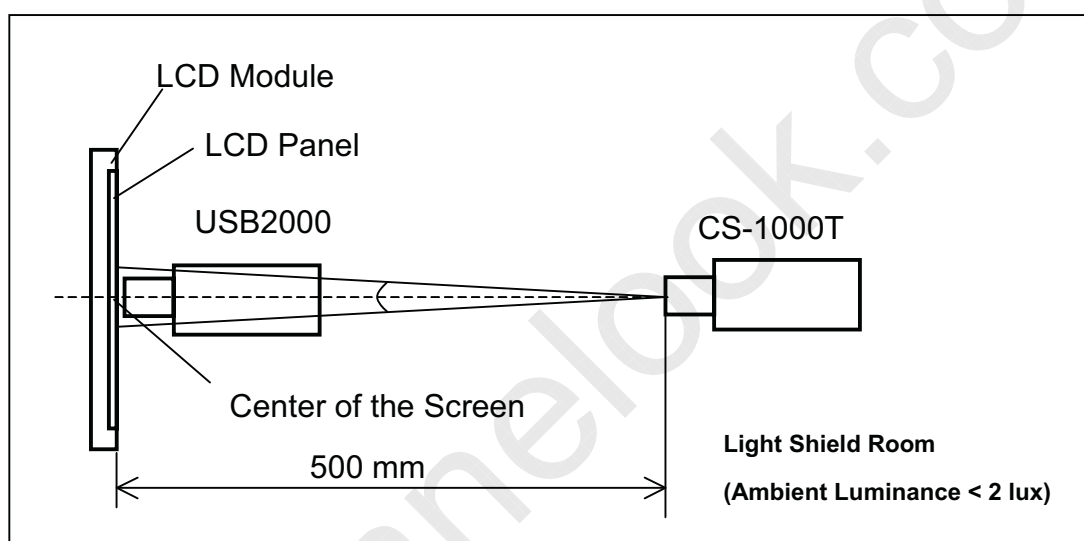
Note (6) Definition of White Variation (δW):

Measure the luminance of gray level 63 at 5 points

δW = { Maximum [L (1), L (2), L (3), L (4), L (5)] / Minimum [L (1), L (2), L (3), L (4), L (5)]

Horizontal Line

Active Area

Version 0.0

Tentative
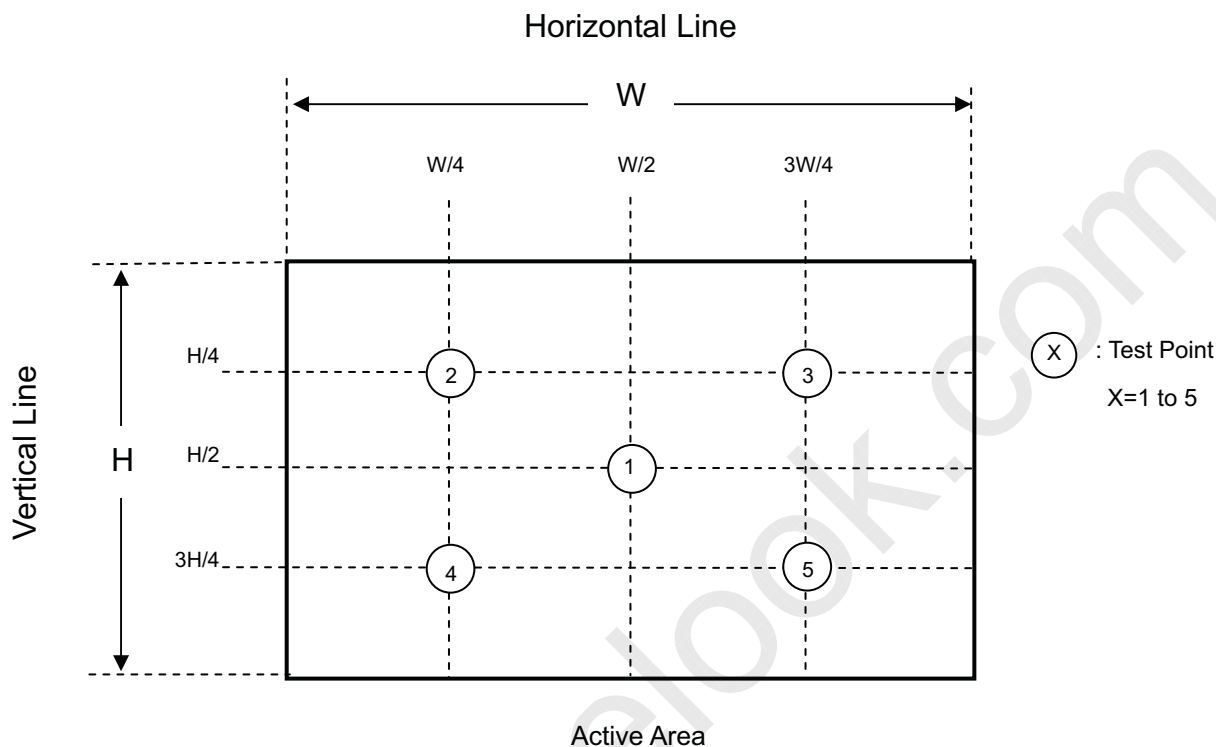
9. PRECAUTIONS

9.1 HANDLING PRECAUTIONS

(1) The module should be assembled into the system firmly by using every mounting hole. Be careful not to twist or bend the module.

(2) While assembling or installing modules, it can only be in the clean area. The dust and oil may cause electrical short or damage the polarizer.

(3) Use fingerstalls or soft gloves in order to keep display clean during the incoming inspection and assembly process.

(4) Do not press or scratch the surface harder than a HB pencil lead on the panel because the polarizer is very soft and easily scratched.

(5) If the surface of the polarizer is dirty, please clean it by some absorbent cotton or soft cloth. Do not use Ketone type materials (ex. Acetone), Ethyl alcohol, Toluene, Ethyl acid or Methyl chloride. It might permanently damage the polarizer due to chemical reaction.

(6) Wipe off water droplets or oil immediately. Staining and discoloration may occur if they left on panel for a long time.

(7) If the liquid crystal material leaks from the panel, it should be kept away from the eyes or mouth. In case of contacting with hands, legs or clothes, it must be washed away thoroughly with soap.

(8) Protect the module from static electricity, it may cause damage to the C-MOS Gate Array IC.

(9) Do not disassemble the module.

(10) Do not pull or fold the LED wire.

(11) Pins of I/F connector should not be touched directly with bare hands.

9.2 STORAGE PRECAUTIONS

(1) High temperature or humidity may reduce the performance of module. Please store LCD module within the specified storage conditions.

(2) It is dangerous that moisture come into or contacted the LCD module, because the moisture may damage LCD module when it is operating.

(3) It may reduce the display quality if the ambient temperature is lower than 10 ºC. For example, the response time will become slowly, and the starting voltage of LED will be higher than the room temperature.

9.3 OPERATION PRECAUTIONS

(1) Do not pull the I/F connector in or out while the module is operating.

(2) Always follow the correct power on/off sequence when LCD module is connecting and operating. This can prevent the CMOS LSI chips from damage during latch-up.

(3) The startup voltage of Backlight is approximately 1000 Volts. It may cause electrical shock while assembling with converter. Do not disassemble the module or insert anything into the Backlight unit.
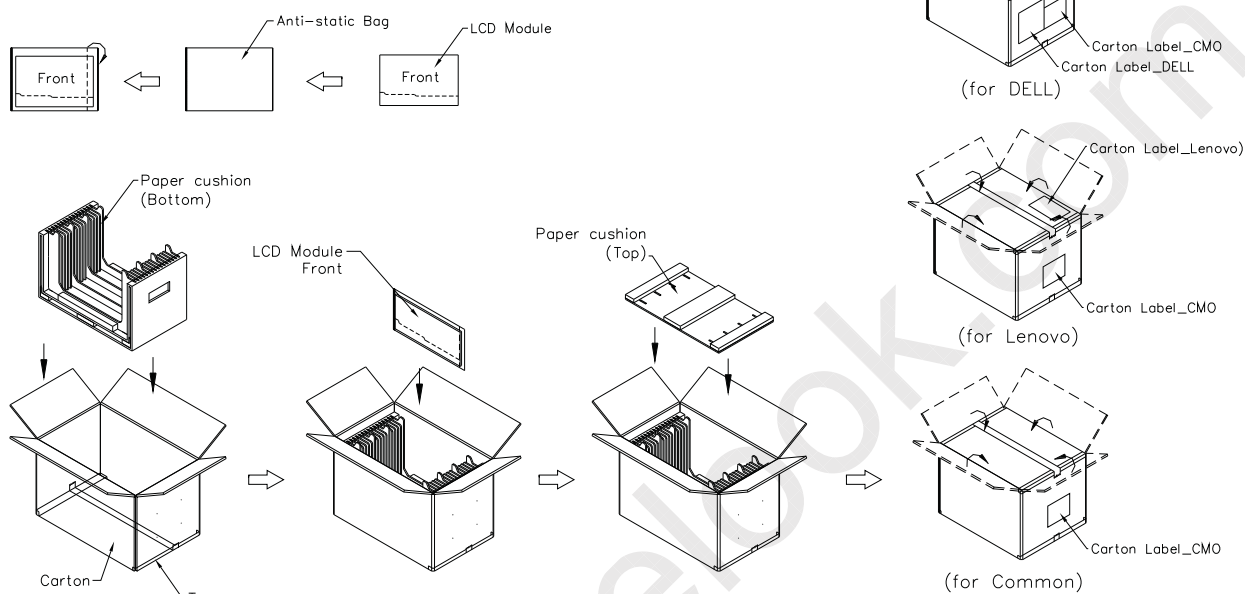
Version 0.0

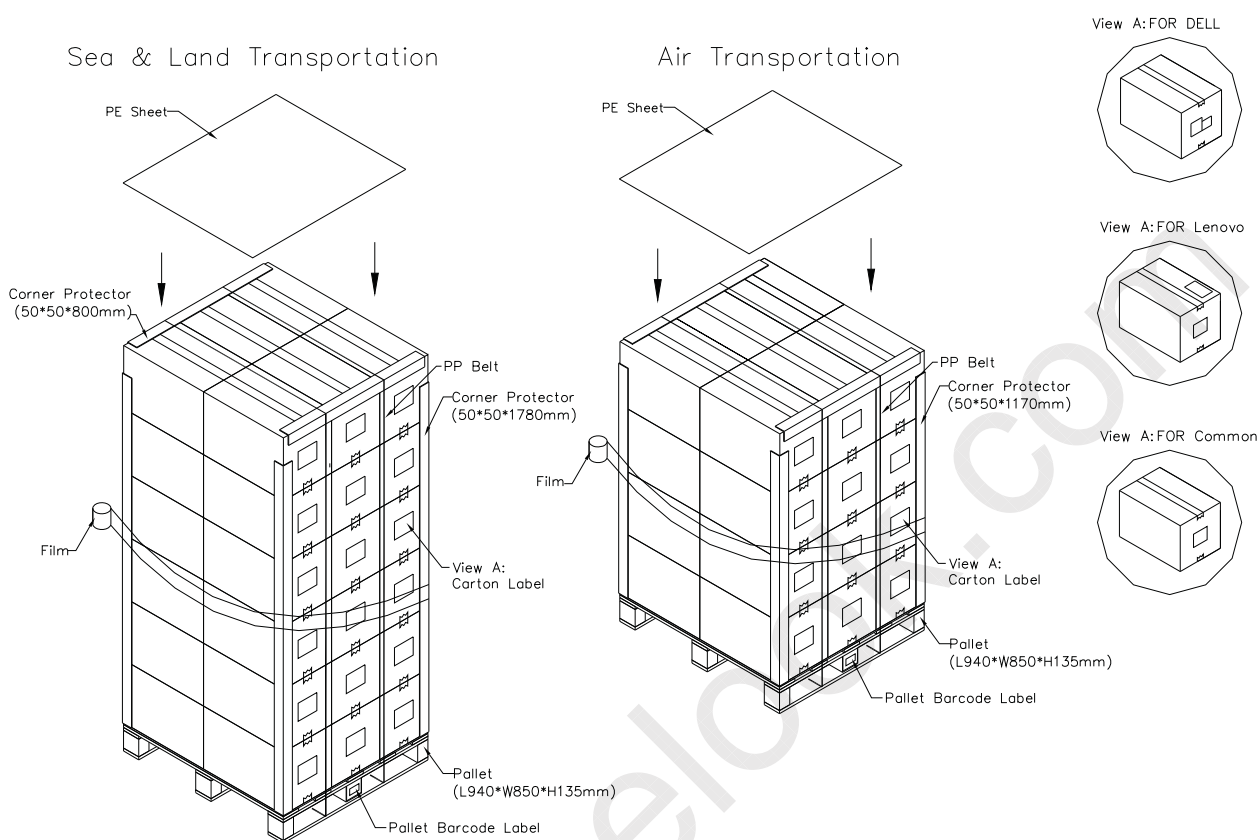## 10. PACKING

10.1 CARTON

Box Dimensions : 470(L)*283(W)*320(H)
Weight: Approx. 10.4kg(15 module .per. 1 box)

Figure. 10-1 Packing method

Version 0.0

10.2 PALLET

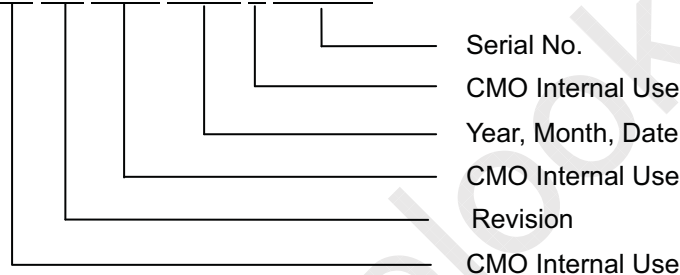**Figure. 10-2 Packing method**

Tentative

11. DEFINITION OF LABELS
11.1 CMO MODULE LABEL

The barcode nameplate is pasted on each module as illustration, and its definitions are as following explanation.

(a) Model Name: N173H6 - L04

(b) Revision: Rev. XX, for example: A1, …, C1, C2 …etc.

(c) Serial ID: X X X X X X X Y M D X N N N N

        Serial No.
        CMO Internal Use
        Year, Month, Date
        CMO Internal Use
        Revision
        CMO Internal Use

(d) Production Location: MADE IN XXXX. XXXX stands for production location.

(e) UL logo: LEOO especially stands for panel manufactured by CMO NingBo satisfying UL requirement. The panel without LEOO mark stands for manufactured by CMO Taiwan satisfying UL requirement.

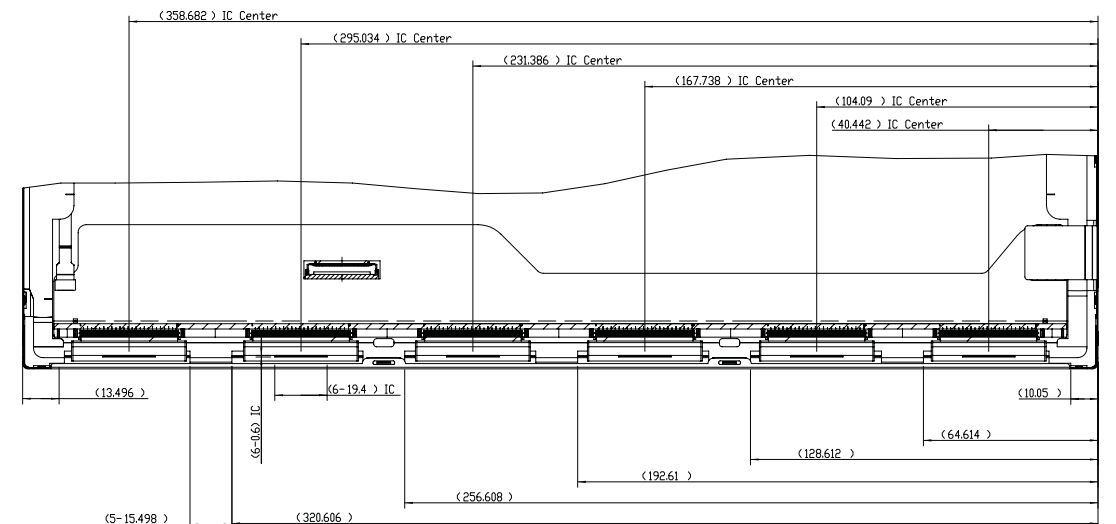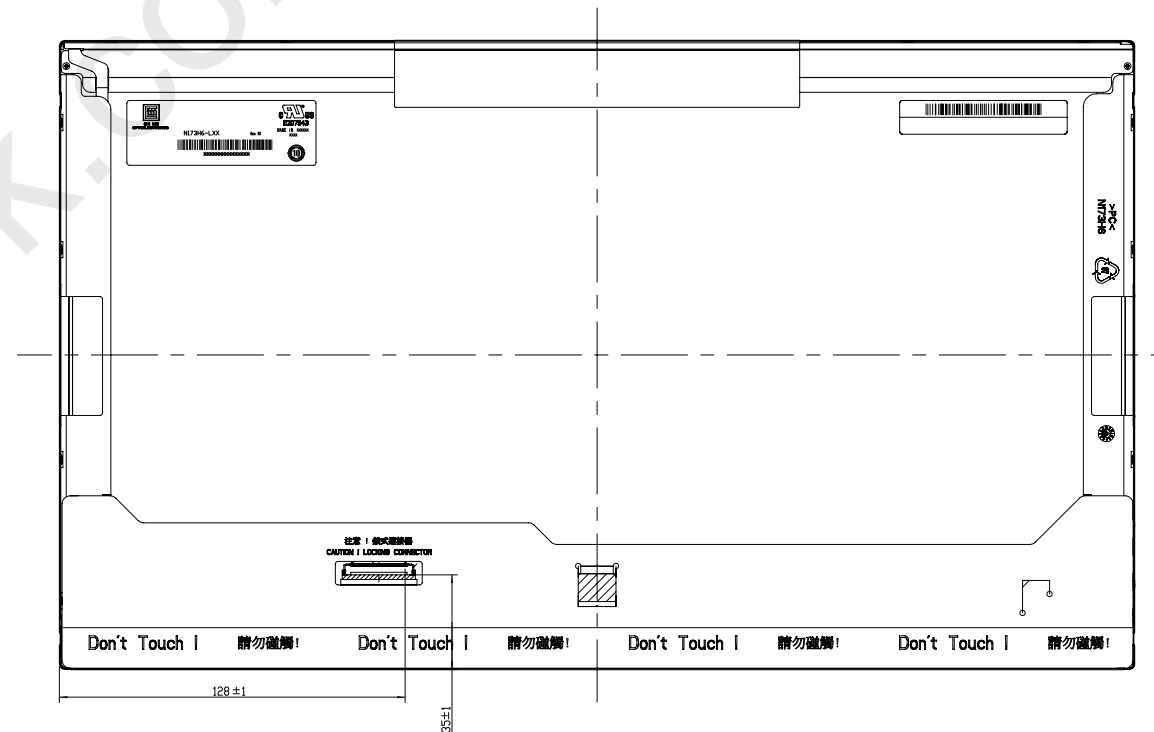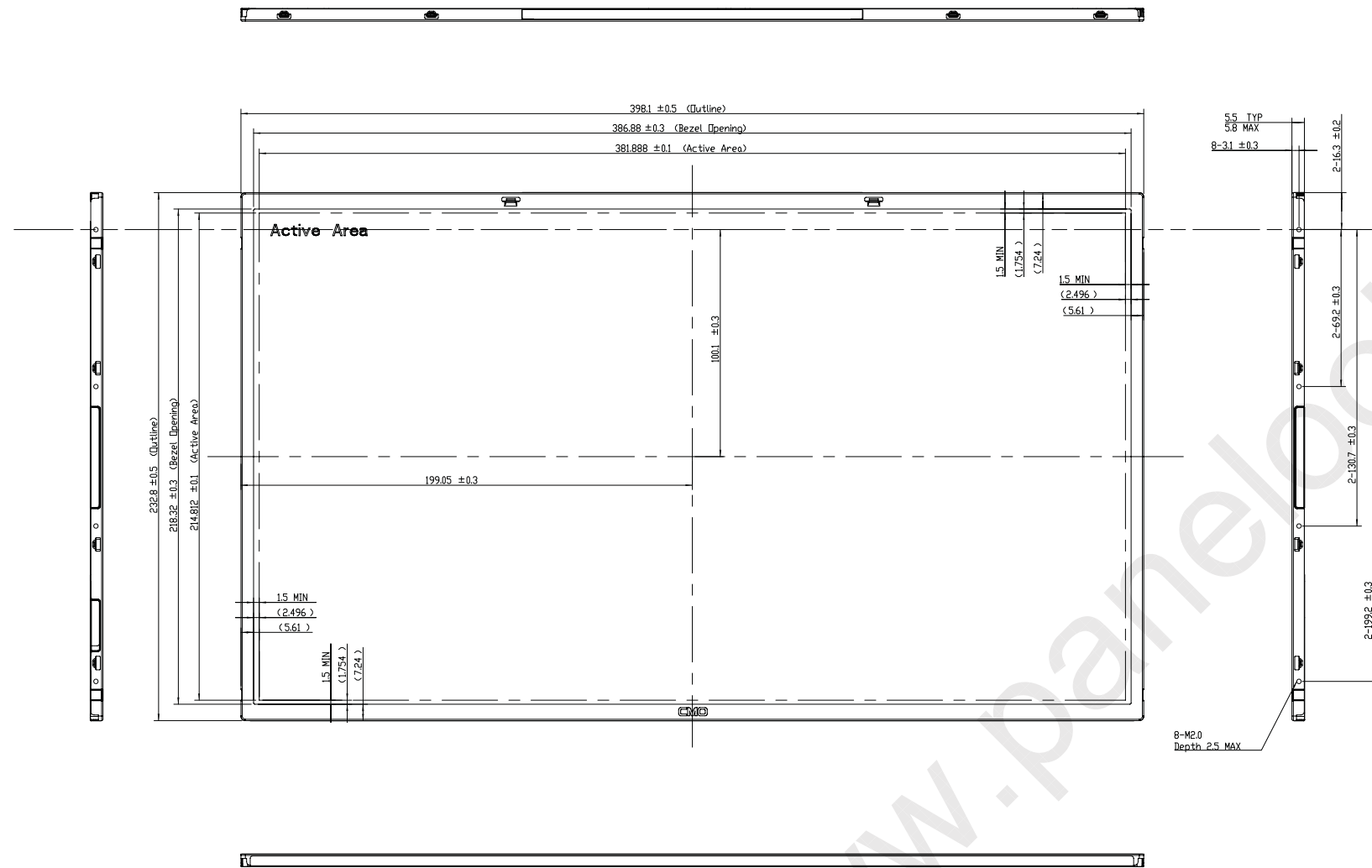Serial ID includes the information as below:

(a) Manufactured Date: Year: 1~9, for 2001~2009

        Month: 1~9, A~C, for Jan. ~ Dec.

        Day: 1~9, A~Y, for 1st to 31st, exclude I , O and U

(b) Revision Code: cover all the change

(c) Serial No.: Manufacturing sequence of product

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11.2 CMO CARTON LABEL

(a) Production location: Made In XXXX. XXXX stands for production location.

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Active Area

398.1 ±0.5 (Outline)
386.88 ±0.3 (Bezel Opening)
381.888 ±0.1 (Active Area)

5.5 TYP
5.8 MAX
8-3.1 ±0.3
2-16.3 ±0.2

1.5 MIN
(1.754)
(7.24)
1.5 MIN
(2.496)
(5.61)

2-69.2 ±0.3

100.1 ±0.3

2-130.7 ±0.3

199.05 ±0.3

2-199.2 ±0.3

232.8 ±0.5 (Outline)
218.32 ±0.3 (Bezel Opening)
214.812 ±0.1 (Active Area)

1.5 MIN
(2.496)
(5.61)

1.5 MIN
(1.754)
(7.24)

8-M2.0
Depth 2.5 MAX

128 ±1
25 ±1

Don't Touch ! 請勿觸摸!   Don't Touch ! 請勿觸摸!   Don't Touch ! 請勿觸摸!   Don't Touch ! 請勿觸摸!

(358.682) IC Center
(295.034) IC Center
(231.386) IC Center
(167.738) IC Center
(104.09) IC Center
(40.442) IC Center

(13.496)
(6- 19.4) IC
(6-0.6) IC
(10.05)
(64.614)
(128.612)
(192.61)
(5- 15.498)
(320.606)
(256.608)

CDF AND IC CENTER LOCATION

NOTES :
1. MAX SCREW LENGTH : 2.5mm.
2. MAX SCREW TORQUE : 2.0 kgf-cm.
3. LCD MODULE INPUT CONNECTOR : I-PEX 20455-040E-12 OR EQUIVALENT.
4. GAP BETWEEN BEZEL AND PANEL : 0.5mm MAX.
5. IN ORDER TO AVOID ABNORMAL DISPLAY, POOLING AND WHITE SPOT,
   NO OVERLAPPING IS SUGGESTED AT CABLES, ANTENNAS, CAMERA, WLAN, WAN OR
   FOREIGN OBJECTS OVER CDF DRIVER IC, T-CON AND VR LOCATIONS.
6. LVDS CONNECTOR POSITION MEASURED AT PIN1 AND ITS OUTER OUTLINE EDGE.
7. FLATNESS SPEC 0.5mm MAX.℗

TITLE	OUTLINE-2 DRAWING N173HG-L01/L02		2D REV. 1.0
			3D REV. 1.0
Approved	Shunnan	Drawing No.	N173241041
Checked	Shunnan	Part No.	NA
Drawer	Philip Lau	Material	NA
Designer	Philip Lau	Date 18-Mar-2009	Scale 1:1 Sheet 1 / 1 All
			Unitmm

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| Mark | Description | Date | Changed_By | Approved_By | ECN No. | Remark |